TR14-79-82

18. A mud spring and a landslip at Deviot

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An investigation was made of the occurrence of a mud spring at the request of J. Miller, and of a landslip at the request of R. Murdoch.

Both localities are at Deviot, about 1½ miles S of the Batman Bridge. There is no reason to suppose any connection between the two phenomena.

THE MUD SPRING

Mr Miller had been aware for over a year of a soft area in a paddock about 30 yd uphill from his house. Earlier this year the ground had risen over an area of about 6 yd square, so that the soft, quaking, grassed surface stood about 18-24 in above the level of the surrounding firm ground. When the mound was disturbed with a spade, liquid mud flowed from a central hole and a pole could be thrust into the mound to a depth of about 7 ft.

The spring was investigated on 19-20 August 1969. An auger hole was drilled near the edge of the raised area, and entered liquid or near-liquid clay at about 2 ft below the surface. Below the mud layer, which was about 3 ft thick, a hard sandy clay bed was sampled.

A hole drilled about 6 yd to the NE of the mound entered moist but firm clay to about 8 ft and no soft layer was found. Similarly, a hole about 10 yd to the SE encountered firm clay, but in this hole water was encountered in fissures in the clay. A flow of about 2 gallons per minute entered the hole and the water level rose from about 8 ft below, to within 1 foot of the surface.

A hole drilled about 10 yd uphill from the mound encountered firm clay below surface gravel derived from nearby basalt.

The paddocks uphill from the mound became increasingly sandy due to sandy soil washed down from the bedded sands which cap the hill. The point at which the clays of the lower slopes disappear beneath the sands of the upper slopes is marked by a line of seepages which have been used to supply Mr Miller's waterhole.

Fissures may form in the clays possibly due to a series of dry years. In the succeeding wet years rain water percolating down through the sands and running off over the clays is able to enter these, and in making its way down slope is able to develop sufficient pressure to break out of the clays near the bottom of the slope. The clay is sufficiently eroded and disturbed by water flowing through the underground fissures to form a liquid mud, the weight of which is usually able to balance the pressure of the water. After rain, however, the additional ground-water pressure causes the ground surface to heave up, and when broken open mud will flow from the mound.

The hole SE of the mound cut a water-bearing fissure which though smaller and less active than that underlying the mound showed that water under pressure was present. The other holes showed that the liquid mud zone is not widespread but is restricted to the area of the mound.

Remedial Measures

It is desirable to restrict the build up of local groundwater pressure: if this is not done the mound formation could extend and might result in a larger mud flow.

The groundwater pressure can be relieved by keeping the top of the mound open so that mud can flow out. As this would be something of a nuisance then it is suggested that a gravel filter be formed in the centre of the mound by lowering a piece of 6-inch rigid polythene pipe into the mud spring and filling it with pea gravel so as to displace the mud from the pipe and form an outlet for the water pressure.

The last two winters have been unusually wet: when more normal conditions return the water pressure should fall naturally.

THE LANDSLIP

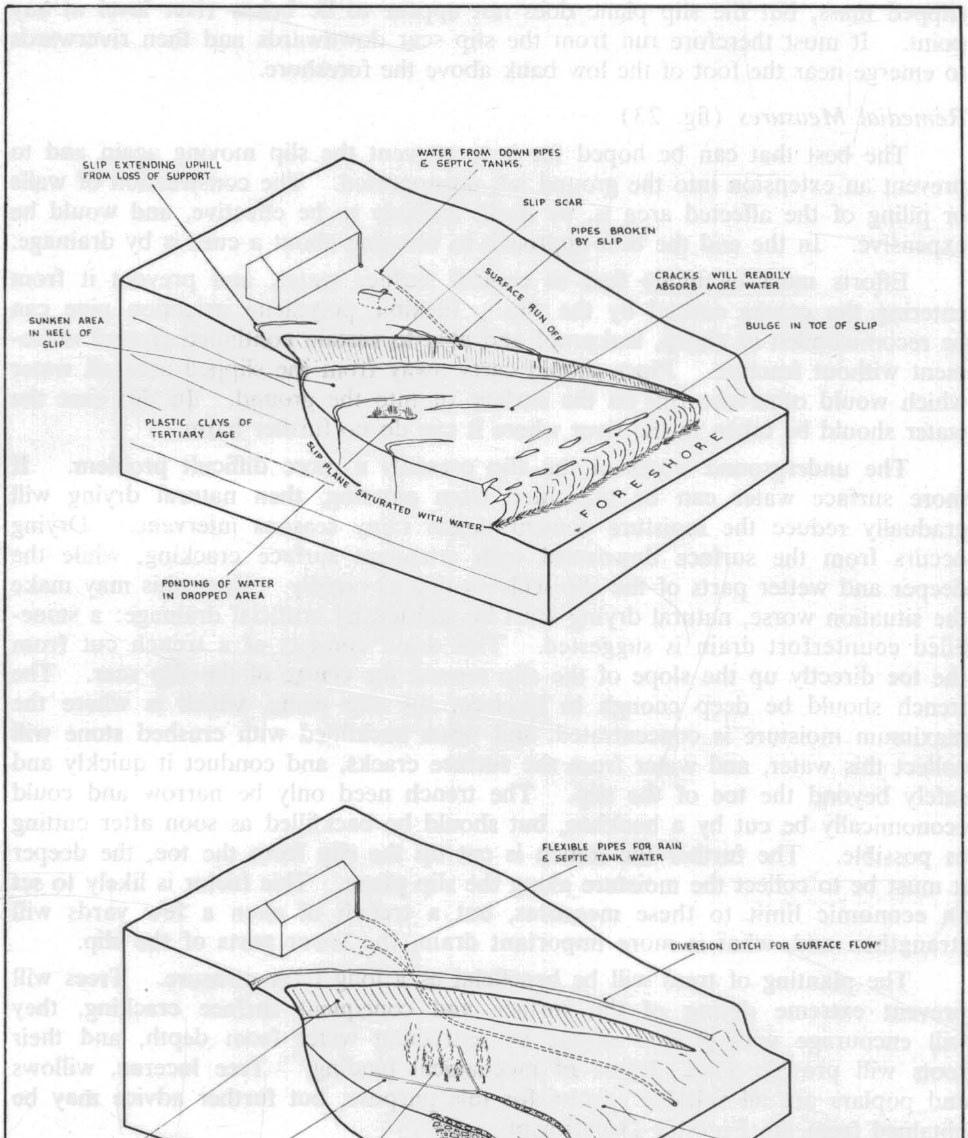
The slip has occurred on five waterside blocks occupied by Messrs Richmond, Brown, Reid, Howe and Murdoch (fig. 23). Apparently a slip occurred last year but the resulting ground disturbance was levelled off with a bulldozer.

Landslips are common in the Tamar Valley where there are a thick series of Tertiary clays and sandy clays. These rocks are notorious in this respect and the cause of these slips may be summed up in one word—groundwater. Typically a series of dry years will cause the clay to shrink and cracks in the surface to open. In the following wetter seasons water enters these cracks and penetrates deep into the clay which becomes soft. Slopes as low as 10° from the horizontal may move under these conditions and even a slight movement will open cracks reaching right down to the soft moist layer. A following wet season will add more water by way of these excellently disposed cracks and the whole situation will culminate in movement involving hundreds or thousands of square yards in sinking and sliding on a soft wet sloping surface—the slip plane. The surface at the top of the slip will sink almost vertically up to 10 or 12 ft, leaving a curved slip scar, while the toe of the slip will bulge up and push downhill over the existing surface. The ground which actually moves will be humped and cracked, and if more rain falls then the whole slip is an ideal condition for the absorption of yet more water.

The clearing of land and reshaping of the surface is often responsible for the initial disturbance but more particularly responsible for the re-routing of surface water flow. Downpipes and soakaway septic tank drainage and garden watering are all effective in concentrating water in the subsoil in a way that happens rarely under natural conditions. Water travels slowly in clays and the slip may not take place for some years after the water content begins to rise.

Once the slip has taken place, a temporary stability is established. The slip itself not only opens cracks however, but breaks drain pipes and channels so that if wetter conditions continue, the slip rapidly saturates and slipping may continue unless determined efforts are made to control the amount of water entering the ground.

At the Deviot slip many of these factors have been active, but particularly a previous slip episode and two unusually wet winters. The slip surface could not be located by drilling, as too many loose boulders were contained within the



SLIP EXTENDING UPHILL FROM LOSS OF SUPPORT
WATER FROM DOWN PIPES & SEPTIC TANKS.
SLIP SCAR
PIPES BROKEN BY SLIP
CRACKS WILL READILY ABSORB MORE WATER
SURFACE RUN OFF
SUNKEN AREA IN HEEL OF SLIP
BULGE IN TOE OF SLIP
PLASTIC CLAYS OF TERTIARY AGE
SLIP PLANE SATURATED WITH WATER
FORESHORE
PONDING OF WATER IN DROPPED AREA
FLEXIBLE PIPES FOR RAIN & SEPTIC TANK WATER
DIVERSION DITCH FOR SURFACE FLOW
NO TRIMMING OF TOE
NO TRIMMING OF SLIP SCAR
SHALLOW DITCHES DRAINING SURFACE
ONE OR MORE COUNTERFORT DRAINS:- A NARROW SLOT AS DEEP AS SLIP PLANE BACKFILLED WITH BROKEN STONE
TREE PLANTING
WATER ESCAPING FROM SLIP PLANE INTO DRAIN
DEPARTMENT OF MINES - TASMANIA
FEATURES OF LANDSLIP AT DEVIOT & POSSIBLE PREVENTIVE MEASURES
Date:- Sept. 1969
Not to Scale
Geologist:- P Stevenson
Draftsman:- P Nankivell
Map sheet & No:- B'field 39
Revisions:-
File No 3276

FIGURE 23

slipped mass, but the slip plane does not appear to lie below river level at any point. It must therefore run from the slip scar downwards and then riverwards to emerge near the foot of the low bank above the foreshore.

Remedial Measures (fig. 23)

The best that can be hoped for is to prevent the slip moving again and to prevent an extension into the ground left unsupported. The construction of walls or piling of the affected area is, by itself, unlikely to be effective, and would be expensive. In the end the best approach to bringing about a cure is by drainage.

Efforts must be made first to control surface water, and prevent it from entering the cracks caused by the slip. Flexible polythene irrigation pipe can be recommended as cheap, leakproof and able to sustain continued ground movement without fracture. Pipes should carry away from the slipped area all water which would otherwise run on the surface or into the ground. In this case the water should be taken to the river where it can do no further harm.

The underground water in the slip presents a more difficult problem. If more surface water can be prevented from entering, then natural drying will gradually reduce the moisture content unless rainy seasons intervene. Drying occurs from the surface downward with attendant surface cracking, while the deeper and wetter parts of the slip will not dry so rapidly. Since this may make the situation worse, natural drying must be assisted by artificial drainage: a stone-filled counterfort drain is suggested. This drain consists of a trench cut from the toe directly up the slope of the slip toward the centre of the slip scar. The trench should be deep enough to intersect the slip plane, which is where the maximum moisture is concentrated, and when backfilled with crushed stone will collect this water, and water from the surface cracks, and conduct it quickly and safely beyond the toe of the slip. The trench need only be narrow and could economically be cut by a backhoe, but should be backfilled as soon after cutting as possible. The further the trench is cut up the slip from the toe, the deeper it must be to collect the moisture along the slip plane. This factor is likely to set an economic limit to these measures, but a trench of even a few yards will strengthen and, what is more important drain, the lower parts of the slip.

The planting of trees will be beneficial as a long term measure. Trees will prevent extreme drying of the surface and conequent surface cracking, they will encourage underground drying by extracting water from depth, and their roots will provide some degree of mechanical binding. Tree lucerne, willows and poplars are all suitable species for this purpose, but further advice may be obtained from the Forestry Department.

It is most undesirable to attempt to reshape the slipped area either by bulldozing material into the hollow formed below the slip scar or by attempting to flatten the heave at the toe. The tendency to slip would be increased in either case, and possibly also by the vibration of the machine itself.